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JUSTIFY RESECTION OR EXCISION,  
IN MODERN WARFARE?

BY

REED B. BONTECOU, M.D.,

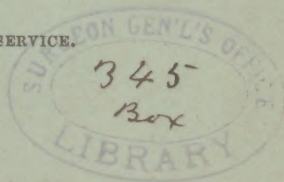
BREVET-COL. AND SURGEON, U. S. V., ETC.; SURGEON TO MARSHALL INFIRMARY,  
TROY, N. Y., U. S. A.

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WITH A DESCRIPTION OF AN

ANTISEPTIC PROVISIONAL WOUND DRESSING FOR THE FIELD,

DEvised FOR THE MILITARY SERVICE.



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Read in the Section of Military and Naval Surgery and Medicine, at the Ninth International Medical Congress, Washington, D. C., September, 1887.



*Authors Compliments*

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## WHAT CLASS OF GUNSHOT WOUNDS AND INJURIES JUSTIFY RESECTION OR EXCISION IN MODERN WARFARE?

SUR QUELLE CLASSE DE BLESSURES DOIT-ON PRATIQUER LA RÉSECTION ET L'EXCISION DANS LA GUERRE MODERNE?

WELCHE KLASSE VON SCHUSSWUNDEN UND VERLETZUNGEN RECHTFERTIGT DIE RESECTION ODER EXCISION IN DER MODERNEN KRIEGSFÜHRUNG?

BY REED BROCKWAY BONTECOU, M. D.,

Brevet-Colonel and Surgeon U. S. Volunteers, etc., Surgeon to Marshall Infirmary, Troy, N. Y.

It is the intention of this paper to consider more especially wounds and injuries incident to modern warfare, and the term "Resection" will be applied to the cutting off the extremities of long bones, and "Excision" to removal of portions of flat bones, and portions of the diaphyses of long bones.

The late American war, and the late European wars, furnish abundant material from which to estimate the value of resection or excision, compared with the expectant plan of treatment, or amputation, for wounds and injuries, and reference will be made to the statistics furnished by these wars, and from other sources.

The late American war furnished 13,000 gunshot injuries of the Head, 4,000 of which were shot injuries of the cranium, 2911 were fractures of both tables without depression, 264 were depressed fractures of both tables, 486 were penetrating, 73 were perforating, 328 were shot contusions, 138 were fractures of the outer table, only, 20 were of the inner table alone, 6 were punctured, and 49 were incised fractures. 320 of these were subjected to excision, with a mortality of 56 per cent. ; in 464 cases bones were removed, and portions elevated, without excision, with a mortality of 48.3 per cent.

It is not my intention to advocate meddlesome surgery, especially about the cranium ; but where there is a depressed fracture, or a contusion of the cranium from shot injury, followed by symptoms of compression, or mental disturbance of any kind, or persistent pain in the head, I think it justifiable and necessary to excise the skull, to give exit to any morbid products that may be within the diploë or within the cranium, and to relieve irritated meninges from possibly depressed inner table, or to remove a compressing clot ; and, where abscess of the brain is suspected, the membrane should be laid open, and, if necessary, the brain explored with a large-size aspirating needle.

The 17 shot contusions subjected to excision, in the late American war, gave a mortality of 75 per cent. This high mortality was doubtless the result, in many cases, of too great delay in performing the operation. For instance, William Attig, private, 49th Pennsylvania Volunteers, was wounded November 7th, 1863, by a musket ball, which struck the skull near the left frontal eminence, denuding the bone of its pericranium for about one inch ; he was admitted to hospital under my charge, November 9th, 1863, complaining of frontal headache ; his pulse was normal, his appetite poor ; November 17th, ten days after the wounding, he had a chill and vomited, and his eyes became suffused and lachrymose. These symptoms continued two days, when I excised a portion of the bone at the site of injury, and, in making the incision through the scalp, pus was seen to be oozing through the denuded bone. On removing the bone, a small quantity of pus was found between the dura mater and the skull. After the operation he was free from pain, but, on the night of the 20th he became delirious, and remained in a stupor until the 24th, when I incised the dura mater and gave exit to a small quantity of pus ; he died two hours after. I relate this case as an example of dilatory and inefficient treatment. His chances for recovery would have been much greater if operated on earlier.

I could relate several other similar instances, where I have regretted not operating sooner. In one case, that of Dennis Sullivan, with gunshot contusion of the os frontis, above the frontal eminence, chills occurred, which were mistaken for malaria; and death resulted from abscess of brain caused by fracturing and displacement of the inner table, which might possibly have been relieved by timely operative interference. The case is reported in the first volume of the Surgical History of the American War, page 148.

A case in point, is related in Hennen's Military Surgery, where Surgeon Cooper excised the skull for a simple shot contusion followed by symptoms of compression, and found the inner table fractured and depressed. Speedy recovery followed the operation. Excision of the skull has been practiced in a number of instances, during the last five years, for the removal of brain tumors, by Hale White and Victor Horsley, of England, Prof. Kroenlein, of Zurich, by Bennett and Goadlee, and by Hirschfelder and Morse, and by Weir, Birdsall and Seguin, of New York. McEwen recently excised the temporal portion of the skull for abscess, with success. All these recent operations were done with antiseptic precautions.

Prof. Thornly Stoker, of London, operated on a man, aged 50, who had sustained an injury of the head nine days before, and was hemiplegic on the left side with indications of intercranial hemorrhage; he was comatose, and had difficult breathing and deglutition, and was rapidly sinking. Excision of a large portion of the right parietal bone discovered a clot an inch thick, by four inches in extent, which was removed, giving consciousness and partial use of his limbs while on the operating table; in three days he fully recovered all his faculties, and remained well.

Depressed fractures of the skull, in my opinion, justify excision as a rule, even if there be no marked symptoms at the time of cerebral irritation or compression, unless the depression be over one of the sinuses, where it might not impinge on the brain. Most of such cases, that are not operated on, are likely to suffer through life from a variety of disabilities, and, not infrequently, result in epilepsy or insanity. A case in point under my observation was that of John Kinchlow, private, 125th Pa. Vols., aged 42 years, who received a compound gunshot fracture of the right parietal bone, in its middle portion, March 31st, 1865, with marked depression, and, as no unfavorable symptoms presented, he was treated on the expectant plan, with simple dressings, and was discharged from the hospital, May 29th, 1865, doing well. After the close of the war this man reported to me every two years for examination for continuance of his pension; it was apparent that his mind weakened, and that he was easily prostrated by heat or exertion; whenever stimulants were taken, even in moderation, he became delirious, and, in one of these paroxysms, he walked into a river and was drowned. His skull is in the Army Medical Museum, and shows a depression of both tables, one-third of an inch in depth. Had excision been practiced soon after the wounding, his condition would probably have been better.

Penetrating gunshot fractures of the cranium are sometimes proper cases for excision. A notable example of this character was that operated on by Prof. Flüller, of Bellevue Hospital, New York, in 1884, and reported in the New York medical journals. The ball, in that instance, entered the os frontis, and passed through the brain to the occiput, being deflected to its position in the posterior cerebrum. Excision of a portion of the occiput, and exploration of the brain, discovered the ball, and its removal was successful under antiseptic precautions and thorough drainage, and he made a good recovery.

Where the missile can be reached safely through the wound of entrance, it should be done. The operator will probably find it necessary to enlarge slightly the wound of entrance in the skull, as the extractor adds to the diameter of the missile.

A case in point was that of Lieut. Burd, aged twenty-six years, who was admitted to the hospital under my charge, February, 1862, with a fistula in the os frontis, the result



of a gunshot wound received seven months before. I dilated the fistula with a sponge tent, and discovered a lead bullet, embedded one and a half inches in the left brain. It was necessary to enlarge the wound of entrance in the skull somewhat, to extract the ball, which was split, and held in its cleft a fragment of the inner table. He recovered, and remained in the service, on modified duty. Many cases are reported where missiles were lodged in the brain, and carried, without serious disability, for years.

Punctured fractures of the cranium, if both tables are implicated, would be proper cases for excision, as the inner table is likely to be depressed. If the puncturing instrument has penetrated the brain to any considerable extent, the excision will ensure drainage, and allow of repositing the depressed inner table. The records of the late American war give six examples of this kind of fracture, with one recovery.

Compound fractures of the skull, from other than gunshot wounds, are almost always indication for excision; one hundred and seven cases reported by Prof. Dennis, of New York, treated by him antiseptically, give a mortality of 30 per cent. Most of these were cases of excision. Dr. Wiseman, of Zurich, reports ninety-five cases of compound fracture from injuries (other than gunshot) treated antiseptically, with the remarkably low mortality of 1.23 per cent., which goes to show that excision of bones of the head may be practiced with comparative safety, under antiseptic precautions.

Gunshot injuries of the shoulder-joint form a large percentage of the wounds received in war that are not mortal, and are of exceeding interest to the surgeon, from the fact that until comparatively recently, amputation was the only resource, where any operative interference was attempted. One thousand and eighty-six resections of that joint were performed in the late American war, with a mortality of 36.6 per cent. 1661 cases are reported by Prof. Gurlt, in his great work on resection, as occurring in all countries between 1792 and 1878, with a mortality of 34.70 per cent. The American cases are included in this number. Amputation at the shoulder joint gives a mortality of 29 per cent.

Primary resections give a mortality of 31.6 per cent.

Intermediary resections give a mortality of 46.4 per cent.

And secondaries a mortality of 29.3 per cent.

Five hundred and seventeen resections of the head of the humerus, with a portion of the shaft, give a mortality of 30.56 per cent.

Forty-three resections of the head of the humerus, with portions of the scapula and clavicle, give a mortality of 24.3 per cent.

Two hundred and seventy-two resections of the head of the humerus alone, give a mortality of 39.33 per cent.

Culbertson's Prize Essay tables, give, for resection of the shoulder for other injuries than gunshot, a mortality of 27.27, and for disease, 25 per cent. These observations are of cases not treated antiseptically.

Five primary resections of the shoulder joint for gunshot fracture are reported by Gurlt, as occurring in the Turco-Russian War; under antiseptic treatment, all recovered; six secondary resections, after unsuccessful expectant and drainage treatment, gave a mortality of 50 per cent. The recent results obtained by antiseptic treatment in gunshot fractures and resections have been exceedingly encouraging.

Reyer reports forty-six cases of gunshot fractures, involving the larger joints, treated conservatively by primary antisepsis, with a mortality of 14.8 per cent.—viz.: one shoulder, one hip, eighteen knee, and five of the foot. Also seventy-eight cases treated by secondary antisepsis, with a mortality of 61.5 per cent.—viz.: seven shoulders, eleven elbows, four of the hip, forty of knees, six of ankles, five of tarsus, and five of hand. Also, sixty-two cases, treated without antiseptic precautions, gave a mortality 77.4 per cent.—viz.: seven shoulders, eleven elbows, six wrists, four hips, twenty-three knees, and eleven ankles.

Nineteen resections of the shoulder joint, for shot fracture, operated on by myself in the American war, gave a mortality of 14.28 per cent. for the secondaries, and 70 per cent. for those operated on in the intermediary stage. Some of the latter class were in a feeble and unhealthy condition, and would probably have been better deferred to a secondary operation. No antiseptic precautions were observed.

It was considered a great advance step in surgery to be able to avoid amputation by resection of the shoulder, and we may reasonably hope for a still greater advance, in being able to avoid resection for many of the gunshot fractures of that joint, by strict antiseptic treatment from the commencement. Amputation need never be done for shot injury of the shoulder or upper arm, where there are soft parts and vessels enough remaining in good condition to keep the extremity alive, for, even with a flail-joint, the limb is useful in giving symmetry to the body, and leaving a tactile extremity, rather than a stump.

Very extensive comminution of the head of the humerus, with great destruction of soft parts, would be a condition justifying resection, as would also necrosis or caries of that bone. The great majority of gunshot fractures of the shoulder joint, which have heretofore been subjected to resection have, by Reyer, Bergmann, and others, been proved to show better results by the expectant plan of treatment, under strict antiseptis.

The usefulness of the limb, after resection of the head of the humerus, depends largely on the fact of ankylosis, which gives a very satisfactory result, as the scapula acquires, by use, very free motions, and although the upward movements of the arm are limited, still, it is infinitely preferable to a flail-joint.

In primary resections, the periosteum is generally sacrificed, especially if three or four inches of the shaft is removed, and there is generally failure to regenerate the bone, and the flail-joint, under these circumstances, is the rule. This might be prevented by wiring the shaft to the scapula, to favor ankylosis, and would be a certain method of securing apposition of the surfaces.

In performing the operation of resection of the shoulder, I have generally utilized the shot wounds, when favorably located, to make the incisions, and have not hesitated to divide the deltoid transversely through its attachment to the acromion, and never failed to get proper and useful union of the soft parts. Where portions of the clavicle or scapula are to be resected with the humerus, this incision has its advantages. Sabre and bayonet wounds of the shoulder, complicated with fracture of the joint, are not likely to require resection; better results can be obtained by the expectant plans, under antiseptic precautions.

Gunshot fractures of the humerus, not implicating the joint extremities, have, in numerous cases, been subjected to excision. About 700 were thus treated in the late American war, with a mortality of 28.5 per cent. while 3000 treated on the expectant plan, gave a mortality of 15.2 per cent. only, and 2000 amputations gave 18.9 per cent. mortality.

While I advocate, in certain cases, limited excision in the diaphysis of the femur, to secure the fractured ends, I fail to see any necessity for excision in the shaft of the humerus, where we can command so much more perfectly the fractured bone by external appliances. Liberal incisions through the deep fascia, to relieve tension and facilitate drainage, the removal of detached fragments and foreign bodies, is all the operative interference required. Where the vessels and soft parts do not demand amputation, necrosis and disease of the bone justifies resection.

The Elbow joint has been resected in 1438 instances for gunshot injury, in all the wars up to 1878, according to the reports of Prof. Gurlt, with a mortality of 24.87 per cent.; 529 cases in the late American war gave a mortality of 22.4 per cent.; 938 cases, treated on the expectant plan, gave a mortality of 10.3 per cent.; 1024 amputations in the arm, for gunshot wound of elbow joint, gave a mortality of 24.3 per cent.; and



according to the table of Culbertson, 477 resections of that joint for other than shot injuries gave a mortality of 10.59 per cent. ; 402 for disease, a mortality of 10.87 per cent. ; and for injuries of various kinds a mortality of 15.15 per cent. Fourteen resections of the elbow joint for shot fractures, operated on by myself in the American war, gave for the secondaries no mortality, and for the intermediaries 50.8 per cent., without antiseptic precautions.

The expectant plan of treatment, in gunshot and other fractures of the elbow joint, is the method promising better results, both as to mortality and usefulness ; but if the joint be extensively opened, and the lower end of the humerus is comminuted, with or without fracture of either the ulna or radius, resection would be justifiable, providing the vessels and sufficient soft parts were in good condition. Extensive injury to the upper extremity of the ulna would also justify partial resection. Unreduced dislocation with ankylosis in a bad position, or ankylosis in a bad position from any cause, or chronic arthritis, caries, or necrosis, would justify resection, partial or complete.

In gunshot fractures, resection, if indicated, should be done primarily under antiseptic rules, and if not practicable, then it is better to defer it for a month, or until the inflammatory stage has passed, as more favorable results will be obtained in the secondary than in the intermediary stage. A number of resections of this joint, made by myself, in the intermediary stage, gave troublesome suppuration, and in some, secondary hemorrhages, although ultimate good results were obtained in most of the cases, and, in a few, movable joints. The surgeon, however, may justly be content with ankylosis in a favorable position.

Excision for gunshot fractures of the bones of the forearm was extensively practiced in this country during the late war. Nine hundred and eighty-six cases are reported with a mortality of 11.2 per cent. In fifty-nine cases both bones were excised. The ulna alone in 496 cases, and the radius alone in 413 cases. Amputation in forearm for gunshot fracture gave a mortality percentage of 13.9. The expectant treatment, in 3000 cases reported, gave a mortality of only 6.4 per cent.

Although the mortality for excision in this part is less than by amputation, it is nearly twice as much as by the expectant plan, and the results as to usefulness were not satisfactory, especially where the radius alone was excised, the hand remaining inclined strongly to the radial border. The vitality of this member is so great that, where the vessels and nerves are not badly damaged, we may trust largely to the efforts of nature, and injuries of extensive and severe degree will, in a majority of cases, make a satisfactory recovery under the expectant treatment, especially if antiseptic dressings are used, and the deep fascia freely divided where there is tension. The bones can be kept in proper position without much difficulty by external appliances. The hand, during treatment, should be kept with the fingers flexed, that in the event of fixation of the tendons these appendages may be left in the most natural and useful position. It has been a common practice to keep the fingers extended during treatment, and frequently permanent stiffness in that position has resulted.

Of the Wrist joint there are reported by Prof. Gurlt, in his work on "Resections," 133 cases of excision, as occurring in all the wars up to 1878, with a mortality of 15.15 per cent. One hundred and two of these in the American war gave a mortality percentage of 15.6. Seven hundred and sixteen shot fractures of the wrist joint, treated on the expectant plan, in the late American war, gave a mortality of 7.6 per cent.

Four cases of secondary resection, in the Turco-Russian war, reported by Gurlt ; under antiseptic dressings, all recovered.

The mortality of resection of this joint, for other injuries than shot wounds, as given by Culbertson's tables, is 11.10 per cent., and for disease 11.76 per cent.

The cases of gunshot wounds of this joint that justify resection are rare, and only to be practiced where the bones forming the joint are comminuted badly ; free incisions

through the fascia, to relieve tension, will enable the natural efforts to repair the most serious wounds. I made several resections of this joint for gunshot wounds in the intermediate stage during the late war, and some made good recoveries. The bones of the Hand seldom require primary excision; removing detached fragments and foreign matter is all that is required, except as a secondary proceeding for necrosis and caries, and other diseases. Resection of the hip-joint, for shot injury, has been practiced on 72 cases in this country prior to 1879, and in Europe in 100 instances with an aggregate mortality of 86.5 per cent. For the primaries 93 per cent., for the intermediaries 96 per cent., and for secondaries 63.4 per cent.

269 cases, in the late American war, that were treated on the expectant plan, gave a mortality of 92.5 per cent., and 66 amputations at the hip joint gave a mortality of 83.3 per cent.

Resection for disease, in civil practice, according to Culbertson's tables, gives a mortality of 45.7 per cent., a majority being in young subjects. All these observations are of treatment not antiseptic. Dr. Yale, of New York, reports in the *Annals of Surgery* for January, 1886, 48 cases by Volkman, with a mortality of 25 to 30 per cent., and 33 cases by Korff, with a mortality of 48.48 per cent., and 166 cases by Gorsch, with a mortality of 36.7 per cent., and 36 cases by Alexander, with a death rate of 30.55 per cent. All of these cases were presumably of disease, and treated antiseptically.

In gunshot fracture of the Hip-joint, involving the head or neck of the femur, primary resection is, under certain circumstances, justifiable, even though there be injury of the acetabulum also. Three cases, with this complication, have been operated on successfully; one by Surgeon Hoff, U. S. A., one by Dr. Schonburn, and one by Dr. Hufelder, of Germany. One resection done by myself, in the intermediate stage, during the late war, resulted fatally.

The propriety of resection will depend somewhat on the necessity for immediate transportation. If transportation is to be for any considerable distance, and in wagons, over rough roads, I should state that amputation would give the better chance for recovery, even though the soft parts were not extensively destroyed. If, however, the transportation is by rail or water, and it is practicable to apply a fixation bandage of plaster or glass, then resection should be practiced, if the head or neck of the bone is comminuted, or if the missile is lodged in the bone or joint. If the neck alone is fractured, without comminution, and the soft parts and vessels are in good condition, the case may be better treated on the expectant plan, under strict antiseptic rules, with thorough drainage, if possible, when suppuration occurs, and this course of treatment would apply to perforating shot wound of the neck of the femur, or trochanters, where the solution of continuity in the bone is not entire. After resection, ankylosis is the result to be desired, as giving the most useful limb and best support, and a fixation bandage that would keep the upper end of the shaft in contact with the acetabulum would be the best and most comfortable dressing. As regards the usefulness of the limb in resected cases, the results, in most cases, are not satisfactory. Ankylosis, which gives the best result, is seldom obtained. Those who recover from amputation, are much better able to help themselves, both as regards locomotion and occupation, than those on whom resection has been practiced.

Excision in the shaft of the femur is a proceeding condemned by many good surgeons. It has, nevertheless, been done quite extensively in this country during the late war, 175 cases having been reported by Surgeon Geo. Otis, U. S. A., in the *Surgical History* of that war, with a mortality of 84.2 per cent. 3767 cases of gunshot fracture of the thigh, treated on the expectant plan, during the same war, gave a mortality of 47 per cent., not under antiseptic dressings. 5 cases, reported by Reyer, from the Turco-Russian war, treated by antiseptic primary occlusion, gave a mortality of 20 per cent., and in 8 cases, treated by antiseptic drainage, all recovered.



Prof. Frederic S. Dennis, of New York, reports 53 cases of compound fracture of the thigh from injuries other than gunshot, treated antiseptically, in a civil hospital, with a mortality of less than 10 per cent. 6369 amputations of the thigh, in the American war, gave a mortality of 54.2 per cent. 3465 cases, from other wars up to 1876, gave a mortality of 50 per cent.

The reports of Bergmann, Volkmann and Reyer, of Germany, from the Turco-Russian war of 1878, concerning the antiseptic treatment of shot fractures of the extremities, would seem to indicate that primary antiseptic occlusion, or sealing together with plaster-of-Paris, or some kind of fixation bandage, is the treatment to be practiced. If this can be accomplished before the wound becomes septic, good results may be anticipated, but if suppuration becomes established, and there is difficulty in maintaining coaptation of the broken shaft (and there almost always is), then an operation tantamount to excision is a justifiable proceeding. That is, cutting down and securing the shaft by wire, as recommended by Surgeon Howard, U. S. A., or by small metal plates and screws, as practiced by Dr. Hausmann, of Hamburg, or, perhaps still better, by silk-worm gut, or chronicized catgut sutures. The liberal division of the deep fascia, and other tissues, for that purpose, would assist in procuring good drainage, and prevent the retention of morbid products. Thorough drainage, with antiseptic dressings, should be used.

I practiced excision on ten cases of gunshot fractures of the thigh, in the middle and upper third, after the battle of Williamsburg, in May, 1862. They had been subjected to rough transportation, and were in a very bad condition. They all proved fatal, from pyæmia and prolonged suppuration. Antiseptic surgery and wiring of bones was not practiced then, and I believe, if they had been used, a fair proportion of those cases would have recovered, with useful limbs. The autopsies on those who survived long enough for bone formation, showed that nature's efforts in that direction had been abundant, but, for want of proper coaptation, it was of no avail. Shot contusions of the femur generally result in necrosis of a limited extent, and, in some cases, osteomyelitis, which, it is suggested, might be prevented by early excision of the contused portion, without destroying the continuity of the shaft. This can be done with the surgical engine, with very little disturbance of the soft parts. 162 cases of shot contusions of the femur were reported, occurring in the late American war, 123 of which were treated on the expectant plan, with a mortality of 22.8 per cent., and 9 cases by amputation, with a mortality of 77.7 per cent.

Resection of the Knee-joint has, thus far, been almost as unsatisfactory as that of the hip joint. Prof. Gurlt, in his work on resection, reports 146 cases, occurring in wars up to 1878, with a mortality of 77.8 per cent. Otis reports 133 cases, from European wars up to 1877, with a mortality of 73 per cent. 57 cases from the American war, with a mortality of 81.4 per cent. 603 resections for disease reported by Culbertson, in his tables on resections, gives a mortality of 29.94 per cent. 28 cases of injuries other than gunshot, 45 per cent. mortality, and 53 cases for deformity, a mortality of 12.5 per cent.

Prof. A. M. Phelps reports in the *Medical Record*, July, 1886, 329 cases of resection of the knee-joint for disease, occurring in Europe and America since 1878, treated antiseptically, with a mortality of 9.42 per cent., and subtracting deaths from causes not attributable to the operation, lowers the mortality to 3.03 per cent., certainly an encouraging statement for antiseptics.

189 gunshot fractures of the knee with amputation at the knee, give a mortality, in the American war, of 56.6 per cent., and amputation in the thigh, in 2377 gunshot fractures of the knee, gives a death rate of 52 per cent., and 868 cases of gunshot fracture of the knee treated on the expectant plan, gave a mortality of 60.6 per cent.

12 cases, reported by Reyer, of gunshot fracture of the knee, treated by antiseptic



primary occlusion, in the Russian army in the Caucasus in 1878, all recovered, and six cases by antiseptic drainage, a 50 per cent. mortality. Reyer further reports 15 cases of gunshot fracture of the knee, with ball embedded in the bones, treated conservatively, by secondary antiseptic means, with a mortality of 93.3 per cent. 4 cases, treated by primary antiseptics all recovered. 9 cases treated without antiseptic precautions, all died. He furthermore gives a series of 46 cases of gunshot wound of the knee-joint; 18, treated by primary antiseptics, with a mortality of 16.6 per cent., and 15 recovered with movable joints. 19 cases, treated by secondary antiseptic means, gave a mortality of 85 per cent., and one stiff knee. 9 cases, treated without antiseptic precautions, gave a mortality of 95.5 per cent. Heintzel reports from the Franco-Prussian war, 529 cases of gunshot wounds of the knee joint, treated in a variety of ways, but not strictly antiseptic, with a mortality of 75.10 per cent. Volkmann reports, between 1873 and 1877, 132 major amputations with only four deaths; and Lister reports 80 major amputations, with a mortality of 2.5 per cent. Bergmann reports 15 cases of gunshot fracture of the knee, occurring at Plevna, in 1878, treated by primary antiseptic occlusion and plaster-of-Paris bandage, with 6.6 per cent. mortality only; in 5 of these cases the ball remained concealed in the joint, and in one, pieces of woollen clothing, which did not interfere with the healing—death subsequently, from other causes, revealed the fact. Bergmann further reports that the most extensive shot injuries of soft parts healed without suppuration under that treatment, but to obtain these results, scrupulous avoidance of interference with the wound, with either probes or fingers, must be observed, and occlusion and a fixation bandage be applied immediately after the wounding, to prevent suppuration, which is the important point to be obtained.

In view of these facts, it may be stated, that most gunshot injuries of the knee are either subjects for amputation, or for the expectant plan, under strict antiseptic precautions, if such treatment can be obtained.

If antiseptic occlusion fails to prevent suppuration, then open the joint freely on all sides, and treat by thorough drainage and antiseptic irrigation. The joint must be laid open so freely, that abscesses cannot form. Only one of three cases of resection of the knee, operated on by myself, in the late war, recovered with a useful limb, and that one was operated on two days after the wounding, the others, at a later period, when suppuration had been established.

If resection is done, it should be primary, if possible, and the opposed surfaces of the femur and tibia secured in apposition, either by wire or sutures, to ensure ankylosis, which is the most desirable result.

The bones of the Leg have been subjected to excision, for gunshot fracture, in the wars of Europe, in 152 instances, with a mortality of 69.7 per cent., and in 387 instances, in the late American war, with a mortality of 28.2 per cent.

3938 cases of gunshot fracture of the leg, treated on the expectant plan, gave a mortality of 18.5 per cent.

3708 amputations, for shot fractures of the bones of the legs, gave a mortality of 34 per cent. for the American, and in 7637 cases in European wars, gave a mortality of 73.8 per cent.

Prof. Dennis, of New York, reports 150 cases of compound fractures of the leg—not gunshot—treated in Civil Hospital, under antiseptic rules, with a mortality of 9.2 per cent. Although the mortality of excision in the leg is less than that of amputation, yet it is twice as much as that of the expectant treatment, and, independent of the mortality consideration, the unfavorable results, as to usefulness and deformity, render the practice undesirable, especially, as regards the tibia, unless as a secondary proceeding for necrosis, where bone formation may replace the part removed. Excision of considerable portions of the Fibula may be done, without interfering so much with the usefulness of the limb. Primary antiseptic occlusion should be practiced in gunshot

fractures of the leg, and if this fail to prevent suppuration, then make free division of the deep fascia, and drainage, with antiseptic irrigation.

Resection of the ankle joint has been done in European wars, from 1854 to 1878, in 150 instances, with a mortality of 33.92 per cent., according to Prof. Gurlt, and in 29 instances in the American war, with a percentage of 29.6 mortality. 1700 gunshot fractures of the Ankle joint, treated on the expectant plan, gave a mortality of 19.5 per cent. 161 amputations, at the ankle joint, gave a mortality of 25 per cent., and 17 secondary amputations, a mortality of 7.7 per cent.; 271 cases, mostly from European sources, a mortality of 55.6 per cent. 4 gunshot fractures of the ankle joint, reported by Reyer, in the Turco-Russian war, treated by primary antiseptic occlusion, all recovered. 2 primary resections, under antiseptic treatment, gave a mortality of 50 per cent. 4 cases reported by Gurlt, of secondary excision after unsuccessful secondary drainage, with a mortality of 25 per cent. 285 cases of excision, for disease and injuries not gunshot, up to 1876, gave, for injuries, 34.84, and for disease, 10 per cent., not under antiseptic treatment. The lowest mortality, for any operation on the ankle joint, was for secondary amputation, 7.7 per cent.; the lowest for excision, was 29 per cent., while a limited number (4) under primary antiseptic occlusion, or sealing, gave no mortality.

There are many cases where one or other of the Malleoli are injured, or where the astragalus alone is fractured, or where the missile is concealed in the joint, or in one of the bones of the joint, where partial resection would be indicated, and where the lower end of the tibia and fibula are comminuted. Complete resection might be justifiable under antiseptic precautions, but I think the most life- and limb-saving practice is the expectant antiseptic, in all cases, unless the injuries are so severe as to demand amputation.

Schuchard, Staff Surgeon of Metz, recommends primary antiseptic occlusion in all wounds, until they reach a field hospital, and resection only when the missile is known to be concealed, or the soft parts extensively destroyed by large projectiles opening the joint. I think it advisable to observe this as a rule, if antiseptic dressings can be supplied, and properly applied on the battlefield.

#### CONCLUSIONS.

- 1st. Gunshot contusions of the cranium, especially those destroying the pericranium, are cases that require close attention, and, on the occurrence of pain in the head, especially with febrile symptoms and mental disturbance, excision of the contused bone is justifiable.
- 2d. Gunshot fractures of the cranium, with depression sufficient to render it probable that the inner table is displaced and depressed, unless it be over the site of one of the sinuses, are causes justifying excision, even should there be no symptoms of cerebral irritation at the time.
- 3d. Gunshot fractures of the humerus, involving the shoulder joint, with extensive comminution of the head of the bone, justify resection, if the important vessels and nerves are not injured. If the comminution is not extensive, then removal of detached fragments and foreign bodies, and making the wound aseptic, and treating antiseptically, without resection, is advisable; the same conclusion applies to the elbow and wrist joints.
- 4th Gunshot fracture of the hip-joint, comminuting, or fracturing the head of the femur, or with the missile impacted in the head or neck of the bone are cases for resection, provided, the great vessels and nerves are uninjured, and the soft parts not extensively destroyed; and provided the man is not to be subjected to rough transportation for any considerable distance. Thorough drainage is necessary, if resection is practiced.
- 5th. Gunshot fractures of the knee-joint, with missile embedded in the lower end

of the femur, or in the articular end of the tibia, or with comminution of the extremity of either of these bones, would justify resection, with thorough drainage, provided the important vessels and nerves are uninjured.

6th. Gunshot fracture, with comminution of the lower extremity of the tibia, involving the articulation, justifies resection ; provided, the important vessels and nerves are uninjured. Antiseptic treatment is a necessity in all cases.

7th. In comminuted gunshot fractures of the diaphysis of the femur, excision is justifiable, for the purpose of securing, by metal plates, or metal or gut sutures, the fractured extremities. Strict antiseptics a necessity, in all cases.

#### DISCUSSION.

Brevet-Colonel H. E. GOODMAN, formerly Colonel United States Volunteers, reported seven cases of resection of the shaft of the femur, after the battle of Chancellorsville, May 3d, 1863, treated in 12th Army Corps Hospital, at Aquia Creek, with everything thought necessary, that money could buy. All died ; one, in hospital at Aquia Creek, and the other six, in a Washington Hospital. These resections were made in accordance with a Circular of Surgeon-General Otis, recommending resection. My conclusion then, was, that it was a bad operation, and should not be performed.

Dr. GOODMAN asked Colonel Bonteou, if he had resigned his brevet commission, and, getting a reply that he had not, recommended to the Surgical Section on Military Surgery, that the word "formerly," only be used, where such commission has been resigned.

By Act of Congress, the title is for life, and has certain advantages, as allowing us to certify on honor, instead of on oath, before the Government.



## FIELD DRESSING.

### A SOLDIER'S PACKET FOR PROVISIONAL WOUND DRESSING.

Devised by R. B. BONTECOU, M. D., Surg. and Bvt. Col. U. S. V., of Troy, New York.

Since it has been demonstrated by Ryer, Volkmann, Bergmann and other surgeons, that gunshot wounds of the most serious character will heal without suppuration if immediately subjected to antiseptic occlusion, it becomes a necessity to equip the soldier with a dressing for his wound, that he can apply himself, as in battle he is more or less remote from surgical aid.

In view of these facts, provisional dressings have been devised by distinguished surgeons and are now in use in Europe and in this country, notably that of Esmarch, of Germany, and of Longmore, of England.

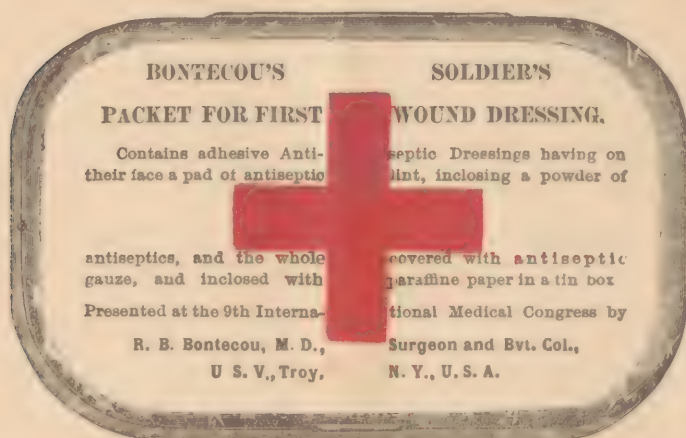
These dressings are of antiseptic tissues or fabrics which require a bandage to secure them in position, and are admirable for the purpose, provided the man is not

disabled in one of his hands, in which event he would find difficulty, if unassisted, in applying the dressing. Moreover, a bandage encircling a limb, may, if the man is obliged to remain many hours without aid, become a discomfort, if not an injury, to a rapidly swelling limb.

To avoid these objections, I have devised an "Adhesive Antiseptic Occlusive Dressing," impervious to fluids, which adheres without warming if pressed to the part, and contains, in its central portion, a quantity of dry antiseptics concealed under antiseptic lint, which is firmly secured to the face of the plaster, which is also covered with two overlapping pieces of antiseptic gauze so folded as to be easily removable with one hand or the teeth, and the whole enveloped in Paraffine paper.

Four of these plasters are contained in a tin box, which is tightly closed by a hinged cover, and can be opened with one hand. (Fig. 1.) The Box is labeled as below, and the directions on its reverse are shown below the Drawing.\*

FIG. 1.



**DIRECTIONS FOR USE :** Clean and dry the skin, unfold the plaster, remove the gauze from its face and use it as a tampon for the wound if necessary, and apply the plaster to the part so that the antiseptic pad will cover the wound. Should the wound be large, two or more of the plasters can be joined together by overlapping their edges and filling up the space between the pads with the sheets of gauze properly folded. The plaster will adhere without bandage and can be reduced in size by tearing off a portion, if desired, which can be used for wounded fingers or toes. Additional strips are also inclosed for that purpose.

Packets of two sizes are furnished. The larger (Fig. 1), containing four dressings, measures  $3\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{4}$  inches, and weighs  $2\frac{1}{2}$  ounces. The smaller (Fig. 2, page 136) contains two dressings, and measures  $3 \times 2 \times \frac{1}{4}$  inches, and weighs  $1\frac{1}{2}$  ounces.

The dressings in the larger packet are each  $6 \times 4$  inches, with a pad of antiseptic lint,  $2 \times 2\frac{1}{2}$  inches, containing ten grains each of dry salicylic acid and iodoform deodorized with Coumarin.†

\* For the French and German translation of above Label see p. 300.

† *Coumarin* ( $C_9H_6O_2$ ) is the chief constituent of Tonka Bean, and is obtained from the *Melilotus Officialis* or the *Liatris Spicata*.—H. H. S.

The dressings in the smaller packet are each  $4 \times 4$  inches, with a pad of antiseptic lint concealing the same amount and kinds of antiseptics as the larger package.

The lint and gauze are made antiseptic with bichloride of mercury, one to one thousand.

The object in furnishing four dressings in a packet is to provide for large wounds, such as are made by shell and large shot, and in the event of such a wound, the four dressings can be converted into one, measuring  $7 \times 11$  inches, by overlapping their edges and filling up the spaces between the pads with the pieces of antiseptic gauze properly folded.

The man should be instructed to unfold the plaster, remove the paper and gauze, and to roll up the pieces of the gauze into tampons, to plug the wounds in case of hemorrhage, and to serve as drainage. Then to apply the plaster so that the antiseptic pad will cover the wound, and by pressing it firmly to the surface for a few seconds, it will adhere securely. The wound of exit, if there be one, is to be treated in like manner.

The packet is shot-proof at ordinary range, and should be carried in the left breast pocket.

FIG. 2.



**DIREZIONE PER USARLA:** Pulite ed asciugate la pelle, stendete l'impiastro, togliete la gaza e usatela come un turaccio per la ferita, s'è necessario, ed applicatela alla parte in modo che il cerotto antisettico copra la ferita. Se la ferita fosse larga, due o più d' questi impiastri possono unirsi, piegandoli in maniera che le due parti si congiungano, edempiendo lo spazio che resta tra i cerotti con i fogli della gaza ben piegati. L'impiastro si attacca senza fasce, e si può ridurre a misura che si vuole stracciandone una parte, la quale può anco usarsi per tagli nelle dita o ai piedi. Si agguingono altri pezzettini per lo stesso uso.

(The Drawings are fac-similes of the Packets.)

The packets are manufactured by Herman Guadendorff, No. 14 Second street, Troy, N. Y., U. S. America.

#### DEBATE.

In discussing the preceding papers on first wound field dressings, Surgeon JOSEPH R. SMITH, U. S. Army, said: My opinions are quite decided that it may be highly advantageous to the soldier to carry with him in campaign, some such packet as those now before us. It is requisite, however, that it be very light, not



weighing more than two or three ounces, and that its contents be antiseptic. It is not necessary that every soldier carry one—as the number of wounds received are not equal to the number of soldiers in a battle. The tendency of opinions in the U. S. Army is in this same direction. A board of officers which recently drew up regulations for a newly-organized hospital corps, adopted a regulation that a packet of this description be carried during the campaign by a certain proportion of the men. In regard to the propriety of this regulation there was no difference of opinion. As to the precise contents of the packet, there was not such unanimity of opinion, and the question was left open for future decision.

Whether justly or not, a large proportion of soldiers in battle experience a sense of security, when they feel that they have on their person the means of protecting themselves against the effects of wounds, because those effects are somewhat indefinite in their minds.

BOÎTE DE BONTECOU

POUR LE PANSEMENT DE CAMPAGNE DES BLESSURES DE SOLDAT.

Cette boîte contient quatre topiques antiseptiques. Chacun d'eux consiste d'un petit coussin de *lint* antiseptique (bi-chlorure), et est doublé d'une couche de poudre d'acide salicylique et d'iodoforme inodore. Ce petit coussin est placé au milieu d'un morceau de taffetas à propriétés très collantes, de sorte qu'il s'applique à la peau sans l'aide de bandages. Tout ce taffetas, est recouvert d'une toile claire antiseptique, et enveloppé de papier paraffiné, et placé dans une boîte à ferblanc à forme de tabatière et d'un poids de moins de 84 grammes.

MODE D'EMPLOI: Dépliez le taffetas, enlevez la toile, et faites-en un tampon si le cas le requiert, puis appliquez le topique sur la blessure. Dans le cas d'une grande blessure prenez deux carrés de taffetas, et même davantage s'il le faut, soudez-les ensemble par la simple juxtaposition de leurs côtés, et remplissez les espaces dépourvus de *lint* avec la toile qui recouvrait le taffetas, puis appliquez le topique. Le taffetas s'attachera de lui même à la peau sans bandages. Si le taffetas est trop grand déchirez-en une partie.

Inventé par R. B. Bontecou, M. D., chirurgien, colonel de U. S. Vol., Troy, N. Y., Etats-unis d'Amérique.

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PAQUETE DEL SOLDADO, DEL DR. BONTECOU,

PARA LA CURA DE UNA HERIDA.

Contiene parches adhesivos, y cada uno tiene una almohadilla de lino antiséptica, incluyendo polvos antisépticos, cubierto todo con una gasa antiéptica, y encerrado con papel parafinado en una caja de hoja de lata. Presentado en el 9o Congreso Internacional de Medicina por R. B. Bontecou, Doctor en Medicina y Cirujía, y Coronel graduado de U. S. V., Troy, N. Y., E. U. de A.

DIRECCIONES PARA USARLA: Limpíese y séquese el pellejo cerca de la herida, desdóblese el parche quítese la gasa, y úsese como tapón para la herida, si es necesario, aplicando el parche de manera que la almohadilla anti-éptica cubra la herida. Si la herida es grande, los parches pueden unirse, llenando los espacio entre las almohadillas con los pedazos de gasa bien doblados. Se adhiere sin bandage, y puede reducirse en tamaño, si es necesario, rasgándolo, usando los pedazos para las heridas en los dedos. Con este objeto, la caja contiene tambien algunos de estos pedazos.

Preparado por H. Gnadendorff, Farmacéutico, Calle 2a, No. 14, Troy, N. Y., E. U. de A.

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BONTECOU'S MILITARISCHER NOTHVERBAND.

Das Packet enthält einige Heft-Verbände. Jeder derselben hat oben ein Kissen von antiseptischer Charpie und darunter ein antiseptisches Pulver. Das Ganze ist mit antiseptischer Gaze bedeckt, dann in Paraffin-Papier gehüllt, in eine Blechdose mit Klappdeckel gepackt, und wiegt weniger als 3 Unzen.

GEBRAUCHS-ANWEISUNG: Man reinige und trockne die Haut im Umfang der Wunde, falte das Pflaster auseinander, nehme die Gaze ab und benütze diese, wenn nöthig, als Bäuschchen für die Wunde; dann lege man das Pflaster auf die Letztere, und zwar so, dass sie von dem antiseptischen Kissen bedeckt ist. Bei grossen Wunden können die Pflaster so an einander gefügt werden, dass sich deren Ränder decken. In diesem Falle falze man die Gaze-Streifen so, dass damit der Raum zwischen den Kissen ausgefüllt werde. Der Verband hält ohne weitere Bandage und kann, wenn gewünscht, durch Abreissen eines Stückes kleiner gemacht werden, welche Stücke, sowohl wie belligeende Streifen, als Verband für Finger und Zehe dienen.

Methode des Dr. R. B. Bontecou, Militärarzt mit dem Range eines Obersten der Ver. Staaten Armee, Troy, N. Y., Ver. Staaten, Nord-Amerika.







